

Seabird Interactions and Mitigation Efforts in Hawaii Longline Fisheries

2020 ANNUAL REPORT



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Pacific Islands Regional Office
NOAA National Marine Fisheries Service
1845 Wasp Blvd.
Honolulu, HI 96818
www.fisheries.noaa.gov/pacific-islands

Please note: Data in this report are considered to be preliminary, and may be revised as better information becomes available. For the most current data, please contact the NMFS Pacific Islands Regional Office.

Front cover: A pair of black-footed albatross. Credit: NOAA Fisheries.

Back cover: Red-footed booby landing on a railing of a fishing vessel. Credit: NOAA Fisheries.



Hawaii longline vessels docked at Pier 17, Honolulu. Credit: NOAA Fisheries.

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1. Introduction

This annual report is required in the Terms and Conditions of the 2012 Biological Opinion of the U.S. Fish and Wildlife Service for the Operation of Hawaii-based Pelagic Longline Fisheries (USFWS 2012).

The National Marine Fisheries Service (NMFS) Pacific Islands Regional Office (PIRO) is responsible for minimizing, as practicable, interactions between Hawaii pelagic longline fishing operations and seabirds. NMFS monitors the fisheries to determine the effectiveness of management measures implemented to minimize interactions and the severity of interactions. NMFS documents interactions and mitigation efforts aboard vessels at sea and reports annually on fishing effort, seabird interactions, and mitigation research. View this report and similar reports from previous years online at <https://www.fisheries.noaa.gov/pacific-islands/bycatch/seabird-interactions-pelagic-longline-fishery>.

1.1 Background

NMFS and the Western Pacific Fishery Management Council (WPFMC) manage two Hawaii pelagic longline fisheries under the Fishery Ecosystem Plan for Pelagic Fisheries of the Western Pacific (FEP) and implementing regulations. The deep-set longline fishery targets primarily bigeye tuna at depths to 400 meters (m) and operates mainly north-northeast and southwest of the main Hawaiian Islands. The shallow-set longline fishery targets swordfish at depths to 100 m and typically operates north and east of the Hawaiian Islands. The FEP contains a detailed description of the two fisheries (WPFMC 2009, as amended).

Since 1994, the Hawaii longline fleet has been limited to 164 permits. Permits allow fishing in both the shallow- and deep- set longline fisheries. Activity levels in any given year since 2004 range from 11 to 35 vessels in the shallow-set fishery, and 111 to 150 vessels in the deep-set fishery. Nearly all vessels in the shallow-set fishery also participate, to some degree, in the deep-set fishery during the year.

Laysan albatross, black-footed albatross, shearwaters, fulmars, boobies, and the endangered short-tailed albatross feed around the Hawaiian Islands in areas where the longline fisheries operate. During the deployment (setting) and retrieval (hauling) of longline fishing gear, hooks and line may occasionally hook or entangle seabirds that attempt to take bait or catch. Seabirds are more likely to drown when the interaction occurs during setting because the weight of the gear may pull the seabird underwater. Although some interactions are inevitable, fishermen take steps to avoid and minimize interactions.

In 2000, NMFS estimated 2,433 seabird interactions in the Hawaii longline fisheries. Beginning in 2001, NMFS implemented a series of seabird mitigation measures, including seabird-deterrent fishing gear and techniques that have reduced interactions. In 2020, there were 32 observed interactions in the shallow-set fishery, which has 100% observer coverage, and an estimated 917 interactions in the deep-set fishery, which has approximately 15% observer coverage (McCracken and Cooper 2021). Observer coverage in the deep-set fishery was reduced in 2020 from the usual 20% due to health, safety, and travel restrictions.

1.2 Seabird Mitigation Measures for the Hawaii Longline Fisheries

Most of the regulations for Hawaii longline fisheries are in Title 50, Code of Federal Regulations, [Parts 600](#) and [665](#) (50 CFR Parts 600 and 665). Regulations specific to the mitigation of seabird interactions and safe handling techniques are at [50 CFR 665.815](#). NMFS also provides a regulation summary and seabird handling guidelines to Hawaii longline fishermen and the general public at <https://www.fisheries.noaa.gov/pacific-islands/bycatch/seabird-interactions-pelagic-longline-fishery>.

The ways that fishermen implement required seabird mitigation measures depend on how and where fishermen fish. Mitigation measures to reduce seabird interactions differ between the two options of stern-setting and side-setting. The following sections describe each of the main gear and operation requirements. The 2012 Biological Opinion (USFWS 2012) also describes these measures.

Stern-Setting versus Side-Setting

Stern-setting is the most common method of deploying longline fishing gear. Crewmen employ a line shooter to set baited hooks from the back of the vessel. Crews that set gear using this method must bait hooks with thawed, blue-dyed bait; attach a weight of at least 45 grams (g) within 1 m of the hook on each branch line; strategically discharge fish, fish parts, or spent bait (together known as “offal”); and remove all hooks from offal discharge as seabird mitigation measures.

In side-setting, crewmen set baited hooks forward and close to the side of the vessel’s hull where seabirds are unable or unwilling to pursue the hooks. With required branch line weighting, the baited hooks will have sunk to a depth where seabirds cannot reach them by the time the vessel stern passes the location where baited hooks have been set (Gilman and Brothers 2006; Gilman et al. 2005, 2007a, 2007b). Additionally, deploying a required bird curtain aft of where crew is deploying the gear inhibits seabirds from landing on the water along the side of the vessel where baits are accessible.

Table 1 summarizes the number of Hawaii deep- and shallow-set vessels observed to set from the stern and from the side in 2020, with some vessels operating in both deep- and shallow-set longline fisheries. In 2020, most vessels in the deep-set fishery and all vessels in the shallow-set fishery chose to stern-set.

Table 1. Number of observed Hawaii longline vessels that side- and stern-set in 2020.

Fishery	Deck setting position	Vessels
Deep-set	Stern-setting	105
Deep-set	Side-setting	21
Shallow-set	Stern-setting	15
Shallow-set	Side-setting	0

Source: NMFS PIRO Sustainable Fisheries Observer Program, unpublished data, 10/15/2021.

Weighted Branch Lines

Fishermen place weights close to the hook on branch lines so baited hooks sink quickly and help prevent foraging seabirds from becoming hooked or entangled in longline gear. When deep-setting north of 23° N (either stern- or side-setting), or shallow- and side-setting anywhere, Hawaii fishermen must attach a weight of at least 45 g within 1 m of the hook to sink

the branch line quickly. Fishermen commonly use weights from 45–80 g.

Thawed and Blue-dyed Bait

Dyeing bait to a specific blue color decreases visibility of the bait by reducing its contrast with the sea surface. Fishermen thaw the bait to increase sink rates and to allow a more effective penetration of the blue dye. Almost all bait used in the Hawaii longline fisheries consists of the fusiform fishes mackerel (saba), sardines, and saury (sanma). NMFS prohibits the use of squid bait in the shallow-set fishery to reduce sea turtle interactions. While fishermen may still use squid in the deep-set fishery, the squid bait costs more than some fish bait and is, thus, less preferred.

Strategic Offal Discards

Fishermen developed the technique of strategically discarding offal on the opposite side of the vessel from fishing operations to distract seabirds from attempting to steal baits. NMFS observers in the mid-1990s noted that this technique reduced incidental hooking or entanglement of albatrosses, though recent experience is raising the question of whether offal discard can have the unintended effect of attracting more seabirds. Further analysis is ongoing. Strategic offal discard is currently required when stern- and deep-setting north of 23° N, or stern- and shallow-setting anywhere.

Night-Setting

Night-setting as a seabird mitigation measure in the shallow-set fishery is based on the premise that seabirds cannot see baited hooks in the dark and, thus, do not attack them. The measure requires shallow-set fishermen, when stern-setting, to start deploying gear no earlier than one hour after local sunset and complete the set no later than the following sunrise. The measure also requires using the minimum lighting necessary to conform to navigation rules and best safety practices. Night-setting has been a very effective seabird mitigation measure, reducing seabird interactions by as much as 98% (McNamara et al. 1999, Boggs 2003).

Table 2 summarizes the seabird mitigation requirements.

Table 2. Seabird mitigation requirements for the Hawaii longline fleet.

What you need to do	Stern-setting		Side-setting	
	Shallow-Set Anywhere	Deep-Set North of 23° N	Shallow-Set Anywhere	Deep-Set North of 23° N
Deploy mainline from port or starboard side at least 1 m forward of stern corner	-	-	Yes	Yes
If line shooter is used, mount it at least 1 m forward from stern corner	-	-	Yes	Yes
Use a specified bird curtain aft of the setting station during the set	-	-	Yes	Yes
Deploy gear so that hooks do not resurface	-	-	Yes	Yes
Attach 45 g or heavier weights within 1 m of hook of each hook	-	Yes	Yes	Yes
Use a line shooter to set the mainline	-	Yes	-	-
Keep two 1-pound containers of blue-dye on boat	Yes	Yes	-	-
Use completely thawed and blue-dyed bait	Yes	Yes	-	-
Keep fish parts and spent bait with all hooks removed for strategic offal discard	Yes	Yes	-	-
Cut all swordfish heads in half, and use heads and livers for strategic offal discard	Yes	Yes	-	-
Night Set - begin set 1 hour after local sunset and finish 1 hour before next sunrise and keep lighting to a minimum	Yes	-	-	-

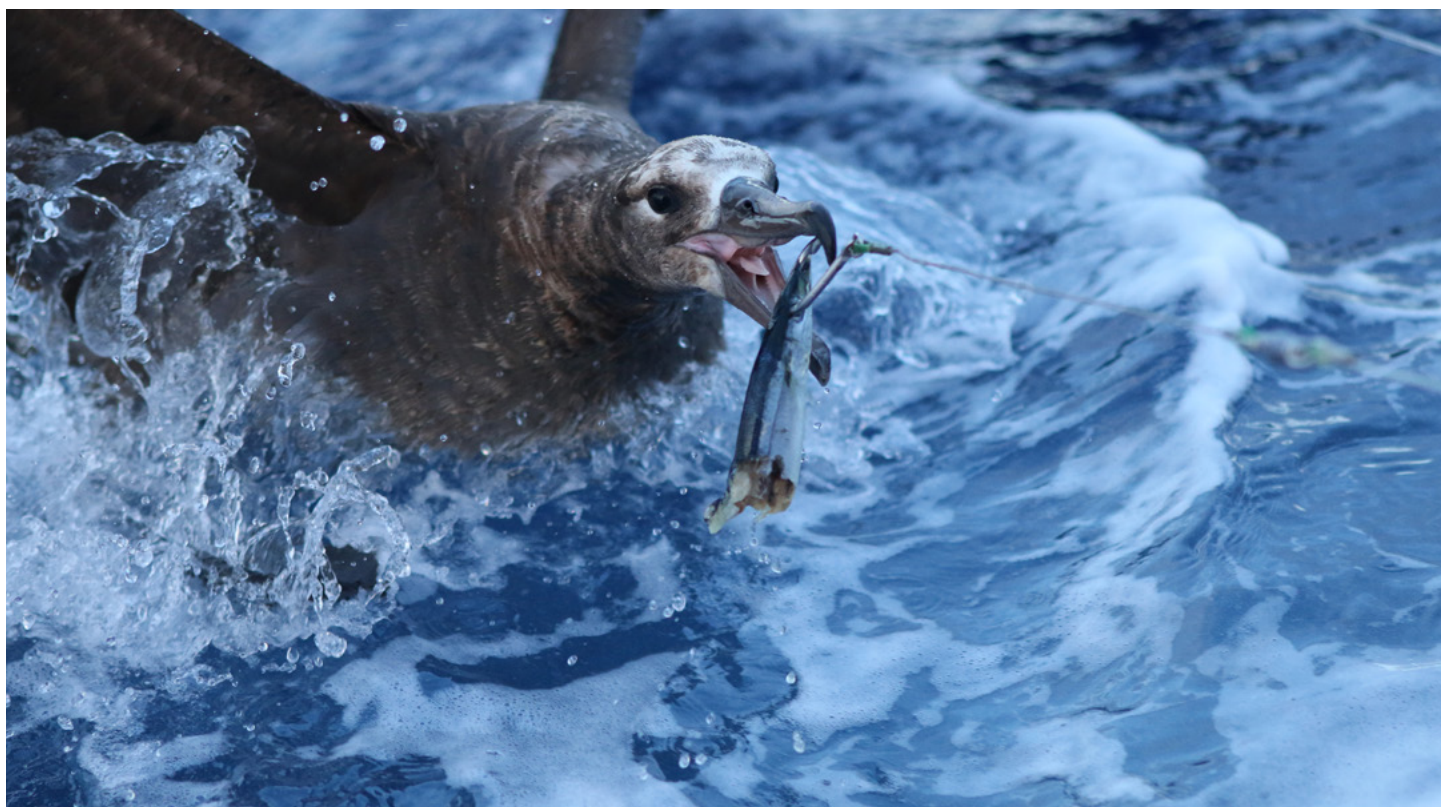
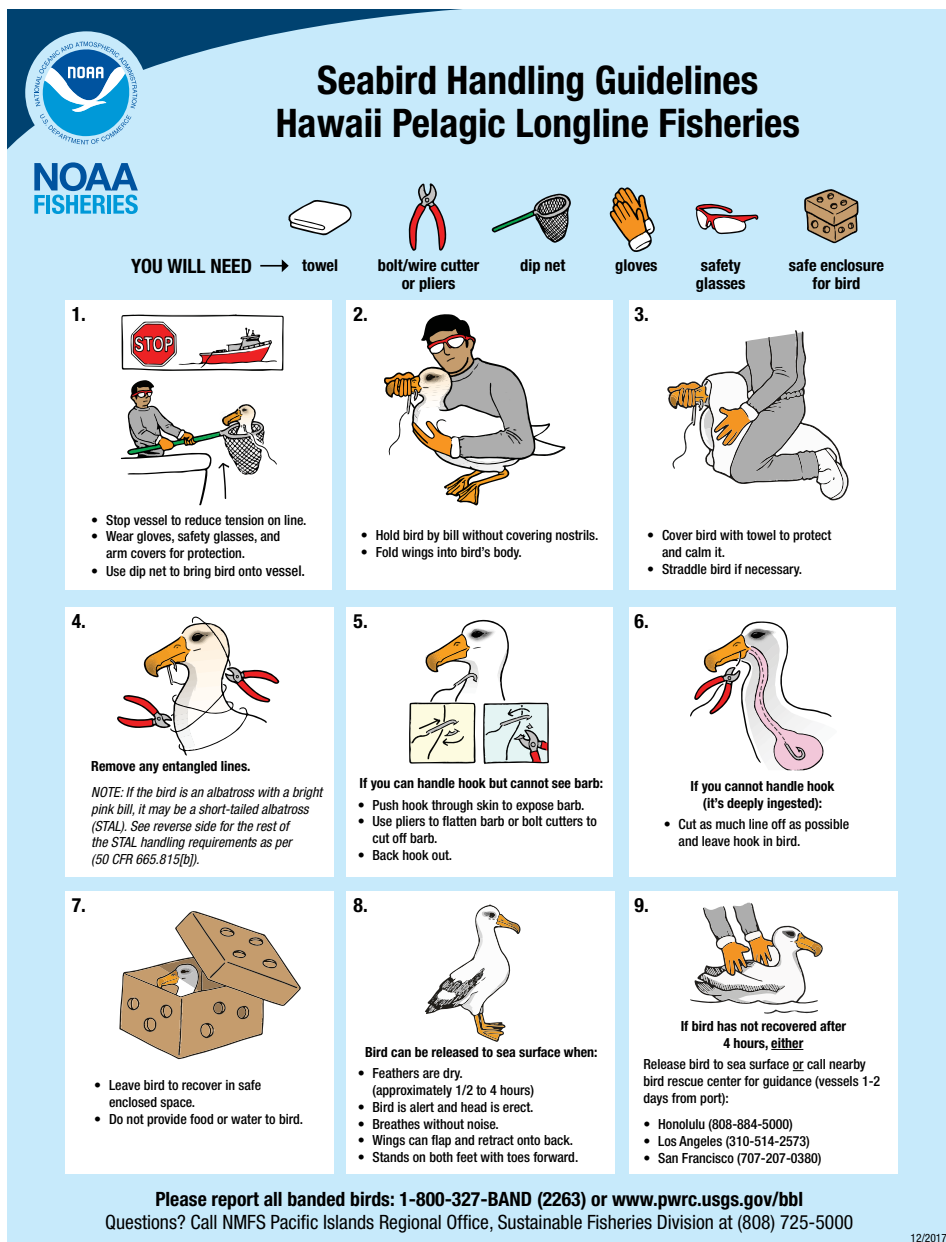
*Black-footed albatross biting on baited hook. Credit: NOAA Fisheries.*

Figure 1. Illustrated seabird handling guidelines developed for use and distribution in protected species workshops.



1.3 Protected Species Workshops

In addition to gear and operational mitigation measures to deter or reduce seabird interactions, owners and operators of pelagic longline vessels must complete a protected species workshop each year ([50 CFR 665.814](https://www.ecfr.gov/current/title-50/chapter-I/subchapter-B/part-665/subpart-1/section-665.814)). The workshop includes training in identification, safe handling, and release techniques for sea turtles, marine mammals, and seabirds (Figure 1). The workshop also reviews regulatory and compliance requirements. In a classroom setting, fishermen learn from oral presentations, hands-on demonstrations, videos, and printed reference materials. NMFS also offers the workshops online for those who have completed at least one in-person workshop training within the past 3 years. A valid workshop certificate is necessary to obtain or renew Federal longline fishing permits, and operators must keep a copy of the certificate on board the vessel while fishing.

Table 3. Hawaii deep- and shallow-set longline fisheries effort and observer coverage, 2019 and 2020.

2019					
Fishery	Number of vessels	Trips	Sets	Hooks	Observer coverage
Deep-set	150	1,724	22,513	63,174,971	20.54%
Shallow-set	15	28	312	374,487	100%

2020					
Fishery	Number of vessels	Trips	Sets	Hooks	Observer coverage
Deep-set	146	1,645	20,785	59,668,443	15.25%
Shallow-set	15	37	479	624,579	100%

Source: NMFS PIRO Sustainable Fisheries Observer Program, unpublished shallow-set data, 10/15/2021, and NMFS 2021a and NMFS 2020.

In 2020, NMFS PIRO provided protected species workshop training for 267 Hawaii-based and 39 American Samoa-based longline vessel owners, operators and crew, and other interested individuals. Starting in March 2020, NMFS live webinar format has increased convenience and accessibility to vessel owners and operators. In addition, NMFS PIRO completed an illustrated guide for proper handling, release, and identification of protected species and, with the WPFMC, translated the guide into languages commonly spoken by operators (Vietnamese) and crew (Tagalog, Indonesian). NMFS distributed all language version copies to all workshop students.

1.4 Fishing Effort and Observer Coverage

Please note that summaries throughout this report and elsewhere may vary slightly depending upon the data source, including revisions. For example, observers may report seabird interactions by date of trip (departure or arrival), set date, or haul date in a given year. NMFS typically bases observer coverage levels on the trip departure date. Alternatively, the NMFS Sustainable Fisheries Observer Programs accounts for protected species interactions based on the vessel arrival date in quarterly, semiannual, and annual reports, <https://www.fisheries.noaa.gov/pacific-islands/fisheries-observers/pacific-islands-longline-quarterly-and-annual-reports>. NMFS also provides summary reports from mandatory logbook data reported by captains.

Table 3 summarizes fishing effort data and observer coverage from 2019 and 2020 by haul date. Observer placement aboard deep-set longline vessels halted temporarily in early 2020 in consideration of COVID-19 and the health and safety of fishermen and observers. NMFS waived placement of observers on 43 trips in the Hawaii deep-set fishery that would typically have carried observers. With enhanced health and safety protocols, observer assignments resumed in May 2020 for the deep-set Hawaii longline fisheries. In the shallow-set fishery, there was no disruption in observer coverage and observers were present on all shallow-set trips. From 2019 to 2020, deep-set fishing trips decreased by 4.6% and shallow-set fishing trips increased by 32.1%.

2. Interactions

2.1 Species

NMFS observers have recorded the following bird species being hooked or entangled in the longline fisheries since 1994, when NMFS began deploying observers: Laysan albatross (*Phoebastria immutabilis*), black-footed albatross (*P. nigripes*), sooty shearwater (*Puffinus griseus*), unidentified shearwaters, brown booby (*Sula leucogaster*), red-footed booby (*S. sula*), Northern fulmar (*Fulmarus glacialis*), glaucous winged gull (*Larus glaucescens*), and an unidentified gull (Table 4). None of these species is listed under the Endangered Species Act (ESA). Both Hawaii longline fisheries have low levels of interactions with these species. Based on the population estimates, the fisheries likely have very little effect on these populations.

Table 4. Species recorded hooked or entangled in Hawaii longline fisheries.

Species	Global population estimate	Demographic information
Laysan albatross	806,693 breeding pairs (ACAP 2021)	The Northwestern Hawaiian Islands (NWHI) has the world's largest colonies and more than 99% of the global breeding population (ACAP 2012a)
Black-footed albatross	70,524 pairs (ACAP 2021)	More than 95% of the population breeds in the NWHI (ACAP 2012b)
Northern fulmar	7 million individuals (Birdlife 2021a)	Located throughout the North Atlantic and North Pacific
Red-footed booby	More than 1 million birds (Birdlife 2020a)	Winter on tropical islands in most oceans
Brown booby	More than 200,000 adults (Birdlife 2020b)	Located throughout the pan-tropical oceans
Sooty shearwater	8,800,000 adults (Birdlife 2021b)	Nest in Australia, New Zealand, and southern South America
Glaucous-winged gull	More than 570,000 individuals (Birdlife 2020c)	Located along the Pacific coast of North America to the northern coast of Japan

Some seabirds, especially shearwaters, are difficult to identify. Table 5 provides a summary of seabird specimens that NMFS observers collected for identification and biological study after capture in the Hawaii longline fisheries in 2020. NMFS observers retain specimens of the first dead Laysan and black-footed albatrosses recovered from each trip, any banded Laysan and black-footed albatrosses, and all other non-Laysan and black-footed albatross species recovered dead from fishing operations. Seabird specimens are frozen and shipped to the Marine Wildlife Veterinary Care and Research Center in Santa Cruz, California. Since 2007, staff with the organization

Oikonos have been collecting morphometric data on shipped specimens.

Table 5. Summary of collected seabirds from the Hawaii longline fisheries, 2020.

Species	Number retained
Black-footed albatross	30
Laysan albatross	22
Brown booby	1

Note: Not all dead seabirds are collected as specimens

Source: NMFS PIRO Sustainable Fisheries Observer Program, unpublished data, 10/18/2021.

2.2 Location of Interactions

Figures 2 and 3 show the spatial distribution of observed seabird interactions in 2020 in the deep- and shallow-set fisheries, respectively. Most of the interactions occur north of 20° N, where seabirds are typically more abundant and fishing effort is more concentrated.

Figure 2. Locations of seabird interactions observed in Hawaii deep-set longline fishery, 2020.

Note: NMFS deployed observers on 15.25% of deep-set trips in 2020.

Source: NMFS PIRO Sustainable Fisheries Observer Program, unpublished data, 10/12/2021.

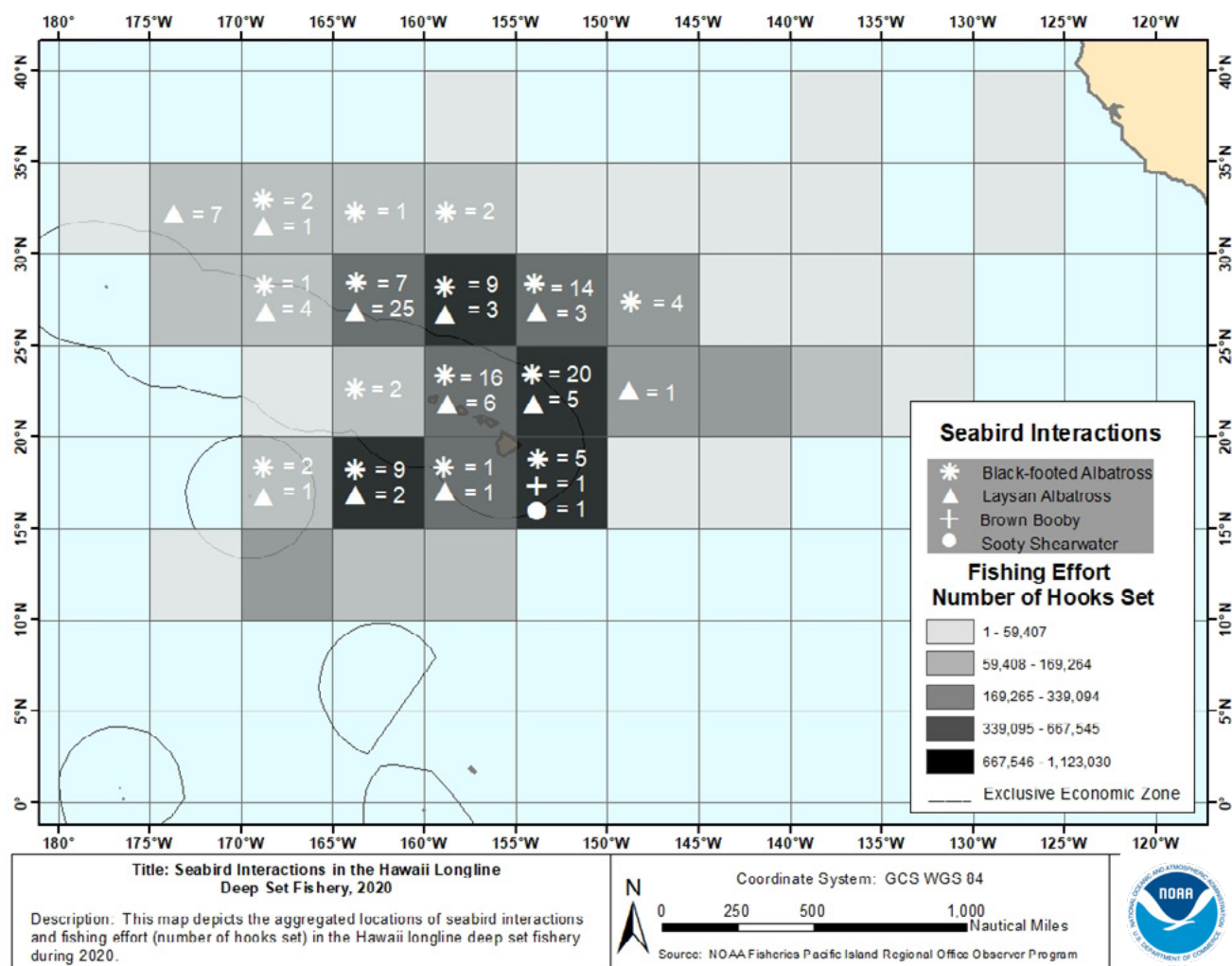
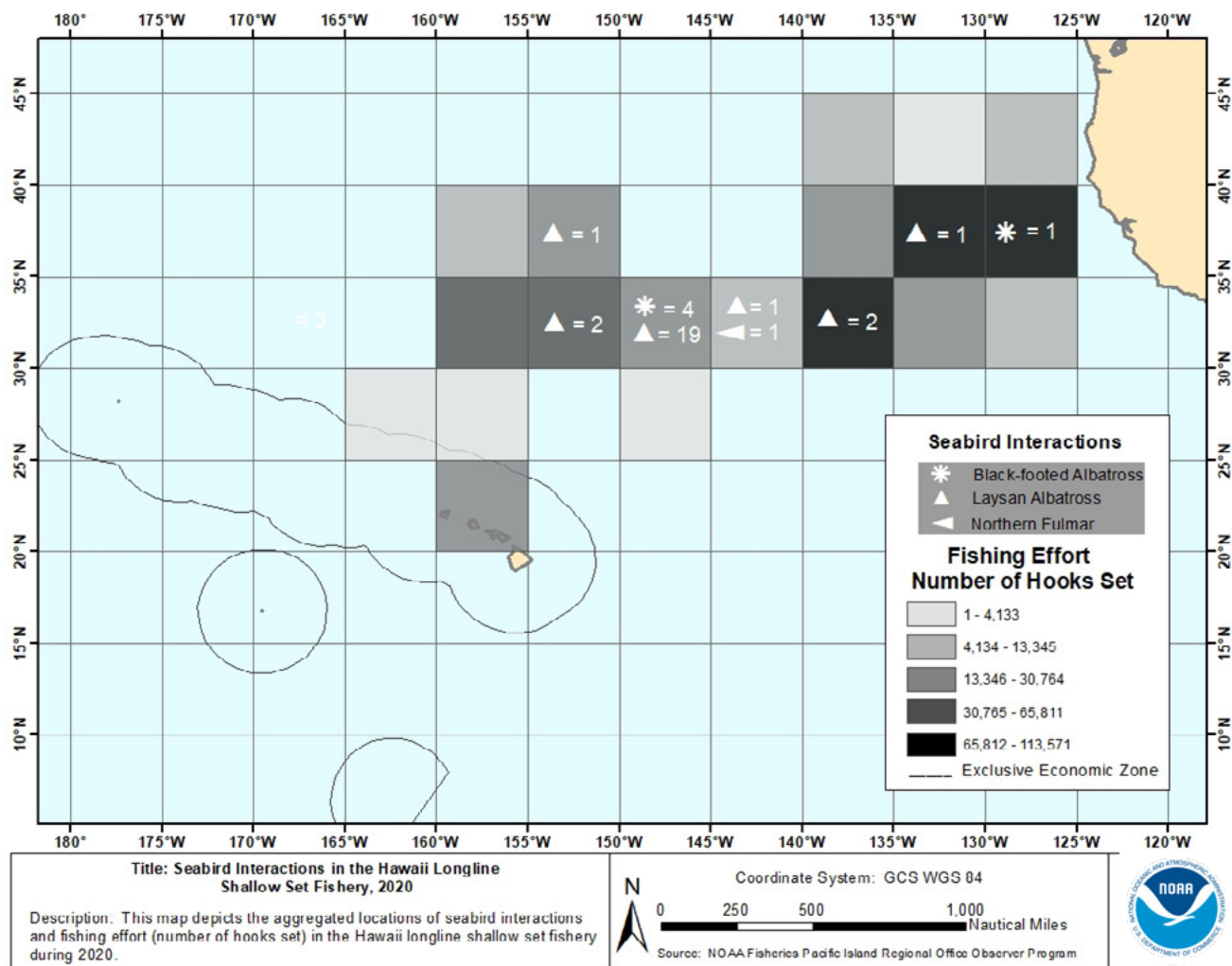


Figure 3. Locations of seabird interactions observed in Hawaii shallow-set longline fishery, 2020.

Note: NMFS deployed observers on every shallow-set trip in 2020.

Source: NMFS PIRO Sustainable Fisheries Observer Program, unpublished data, 10/12/2021.



2.3 Number of Interactions

Table 6 summarizes observed seabird interactions in both fisheries from 2004–2020. During that period, NMFS deployed observers on 100% of shallow-set fishing trips; therefore, the number of interactions shown in Table 6 represents the fishery-wide totals. NMFS deployed observers on 15.25% of deep-set trips in 2020, so we expanded the observed interactions using the observer coverage rate to estimate total interactions (Table 7). Figure 4 shows the seabird interaction rate from 2004–2020 using the data from Table 6.

Almost all interactions in the deep-set fishery occur when fishermen set gear during the day while

seabirds are actively feeding. Seabirds may be hooked or entangled and then drown while the gear sinks. Because most seabirds are inactive at night, very few interactions occur when fishermen typically haul deep-set gear. In 2020 in the deep-set fishery, observers documented interactions with 59 Laysan albatrosses, 95 black-footed albatrosses, 1 brown booby, and 1 sooty shearwater (Table 6). Nearly all of the seabirds observed to interact with the deep-set fishery were dead (92%). Table 7 contains the total estimated number of interactions with Laysan albatrosses, black-footed albatrosses, brown boobies, and sooty shearwaters based on observer records for the deep-set fishery in 2020.

Table 6. Numbers of observed seabird catches, fishing effort, and interaction rates in the combined Hawaii longline fisheries, 2004-2020.

Deep-set Fishery

Year	Laysan albatross	Black-footed albatross	Sooty shearwater	Other or unidentified bird species caught	Total birds observed caught	Birds released injured and alive	Birds released dead	Total observed effort (hooks)	Seabird interaction rate (birds per 1,000 hooks observed)
2004	2	5	-	2	9	-	9	7,900,681	0.001
2005	6	11	-	1 ¹	18	-	18	9,360,671	0.002
2006	1	17	5	-	23	-	23	7,540,286	0.003
2007	7	18	-	-	25	-	25	7,620,083	0.003
2008	14	30	14	2 ²	60	4	56	8,775,951	0.007
2009	18	23	4	-	45	-	45	7,877,861	0.006
2010	39	17	1	-	57	1	56	8,184,127	0.007
2011	32	13	3	-	48	2	46	8,260,092	0.006
2012	31	36	6	-	73	5	68	8,768,728	0.008
2013	48	49	8	-	105	5	100	9,278,133	0.011
2014	12	38	1	-	51	6	45	9,608,244	0.005
2015	25	101	4	2 ⁴	132	19	113	9,393,234	0.014
2016	33	104	4	3 ⁵	144	7	137	9,882,920	0.015
2017	38	103	-	1 ⁶	142	13	129	10,148,195	0.014
2018	35	190	9	2 ⁸	236	28	208	11,751,242	0.020
2019	43	145	-	1 ⁹	189	8	181	12,948,077	0.015
2020	59	95	1	1 ¹⁰	156	13	143	8,738,011	0.018

Shallow-set Fishery

Year	Laysan albatross	Black-footed albatross	Sooty shearwater	Other or unidentified bird species caught	Total birds observed caught	Birds released injured and alive	Birds released dead	Total observed effort (hooks)	Seabird interaction rate (birds per 1,000 hooks observed)
2004	1	-	-	-	1	1	-	76,750	0.013
2005	62	7	-	-	69	47	22	1,328,806	0.052
2006	8	3	-	-	11	5	6	745,125	0.015
2007	40	8	-	-	48	40	8	1,292,036	0.037
2008	33	6	-	-	39	24	15	1,350,127	0.029
2009	81	30	1	-	112	88	24	1,767,128	0.063
2010	40	38	-	1 ³	79	61	18	1,828,529	0.043
2011	49	19	-	-	68	53	15	1,611,395	0.042
2012	62	37	-	-	99	78	21	1,418,843	0.070
2013	45	28	2	-	75	48	27	1,000,084	0.075
2014	39	32	1	-	72	56	16	1,509,727	0.048
2015	43	38	-	-	81	65	16	1,286,628	0.063
2016	25	40	-	-	65	50	15	830,177	0.078
2017	6	53	-	1 ⁷	60	38	22	1,051,426	0.057
2018	2	7	-	-	9	7	2	546,371	0.016
2019	15	19	-	-	34	26	8	374,487	0.091
2020	26	5	-	1 ¹¹	32	32	-	588,481	0.054

¹brown booby; ²red-footed booby and unidentified seabird; ³northern fulmar; ⁴red-footed booby and unidentified shearwater; ⁵two red-footed boobies and one unidentified albatross; ⁶unidentified gull; ⁷glaucous-winged gull; ⁸one brown booby and one red-footed booby; ⁹brown booby; ¹⁰brown booby; ¹¹northern fulmar.

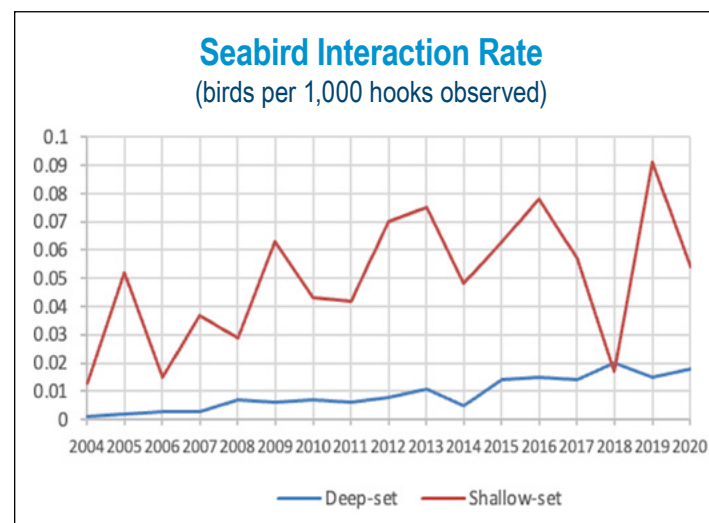
Note: Sustainable Fisheries Observer Program data (unpublished, 10/18/2021) are based on the date and time of the beginning of the haul, with the exception of the total observed effort (hooks), which is based on arrival date from the Sustainable Fisheries Observer Program annual reports (NMFS 2021b and NMFS 2021c). Interaction rates are calculated and rounded to the nearest thousandths (third decimal) place.

Table 7. Estimated total seabird interactions in the Hawaii deep-set longline fishery, 2020.

Species	Total annual estimate
Black-footed albatross	590
Laysan albatross	315
Brown booby	5
Sooty Shearwater	7

Note: Table lists point estimates of the total number of incidental interactions by species in the Hawaii deep-set longline fishery based on observed interactions during 2020. Point estimates are based on the trip arrival date rather than trip haul date. Source: McCracken and Cooper 2021.

Figure 4. Seabird interaction rates in the deep-set and shallow-set longline fisheries, 2004-2020.



The shallow-set fishery typically sets at night and hauls the gear during the day; therefore, most of the interactions occur when fishermen retrieve the gear and birds are actively feeding. In 2020, the shallow-set fishery interacted with 26 Laysan albatrosses, 5 black-footed albatrosses, and 1 Northern fulmar (Table 6). Fishermen released all seabirds alive.

Seabirds can be hooked, entangled, or both. Table 8 provides a summary of capture and release conditions in 2020. Regulations require fishermen to remove as much gear as safely possible from any seabirds captured before releasing the seabirds.

Table 8. Capture details by species for seabird interactions on observed trips in the Hawaii longline fisheries, 2020.

	MANNER OF INTERACTION			
	Hooked only	Entangled only	Both hooked and entangled	Not known or not recorded
Laysan albatross	74	5	6	0
Black-footed albatross	85 ¹	3	12	0
Brown booby	1	0	0	0
Sooty Shearwater	0	1	0	0
Northern Fulmar	1	0	0	0

Note: Regardless of species or manner of capture, all seabirds which were released alive were released without any gear attached to the bird. ¹One dead black-footed albatross (included here) was recorded as hooked, and it was unknown if it was also entangled.

Recovered Seabird Bands

State and Federal agencies and other groups attach identification bands to the legs of birds to study bird movement, survival, and other characteristics. Table 9 provides a summary of observed seabirds with leg bands from Hawaii longline fisheries interactions in 2020.

Most of the recovered bands were from albatrosses banded on French Frigate Shoals in the Northwestern Hawaiian Islands and caught incidentally in the first half of the year.

Table 9. Observed interactions of seabirds with bands in the shallow-set and deep-set Hawaii longline fisheries, 2020.

Species	Disposition	Band(s) recovery date	Date banded	Location banded	Age at banding (yr)	Age at recovery (yr)
Laysan Albatross	Dead	1/18/2020	5/27/1994	French Frigate Shoals (Tern Island)	<1	26
Laysan Albatross	Dead	1/19/2020	6/6/2003	French Frigate Shoals (Tern Island)	<2	17
Black-footed Albatross	Dead	1/30/2020	5/20/2008	French Frigate Shoals (Tern Island)	<1	12
Black-footed Albatross	Dead	1/23/2020	12/28/2003	French Frigate Shoals (Tern Island)	>3	>20
Laysan Albatross	Dead	2/3/2020	12/21/2005	French Frigate Shoals (Tern Island)	<1	15
Black-footed Albatross	Dead	2/8/2020	6/5/2002	French Frigate Shoals (Tern Island)	<1	18
Laysan Albatross	Dead	2/5/2020	5/29/2009	Kauai (Kilauea Point)	<1	11
Black-footed Albatross	Dead	2/6/2020	5/22/2019	Oahu (Kahuku)	<1	1
Black-footed Albatross	Injured	2/12/2020	1/2/2007	Midway Atoll (Eastern Island)	>1	>13
Black-footed Albatross	Dead	2/26/2020	11/29/2005	French Frigate Shoals (Tern Island)	>1	>15

Species	Disposition	Band(s) recovery date	Date banded	Location banded	Age at banding (yr)	Age at recovery (yr)
Black-footed Albatross	Dead	2/6/2020	6/15/2010	French Frigate Shoals (Tern Island)	<1	10
Black-footed Albatross	Dead	2/6/2020	5/31/2002	French Frigate Shoals (Tern Island)	<1	18
Laysan Albatross	Dead	2/8/2020	6/5/1990	French Frigate Shoals (Tern Island)	<1	30
Laysan Albatross	Dead	2/8/2020	12/14/2011	Kauai	>1	>9
Black-footed Albatross	Dead	2/9/2020	2/1/1998	French Frigate Shoals (Tern Island)	>1	>22
Laysan Albatross	Dead	2/10/2020	12/9/2002	French Frigate Shoals (Tern Island)	>3	>21
Laysan Albatross	Dead	2/10/2020	1/15/1981	French Frigate Shoals (Tern Island)	>3	>39
Black-footed Albatross	Dead	2/27/2020	6/16/2010	French Frigate Shoals (Tern Island)	<1	10
Laysan Albatross	Dead	2/19/2020	6/14/2001	French Frigate Shoals (Tern Island)	<1	19
Laysan Albatross	Dead	2/19/2020	5/14/1992	French Frigate Shoals (Tern Island)	<1	28
Laysan Albatross	Dead	3/5/2020	12/9/2002	French Frigate Shoals (Tern Island)	>3	>21
Black-footed Albatross	Dead	3/7/2020	12/9/2015	Midway Atoll (Eastern Island)	>1	>6
Black-footed Albatross	Dead	3/16/2020	6/5/2006	French Frigate Shoals (Tern Island)	<1	14
Black-footed Albatross	Dead	6/7/2020	5/16/2010	French Frigate Shoals (Tern Island)	<1	10
Laysan Albatross	Dead	6/11/2020	4/16/2007	Oahu (Kaena Point)	<1	13

Source: NMFS PIRO Sustainable Fisheries Observer Program, unpublished data, 10/19 /2021.



Banded Laysan albatross in flight. Credit: NOAA Fisheries.

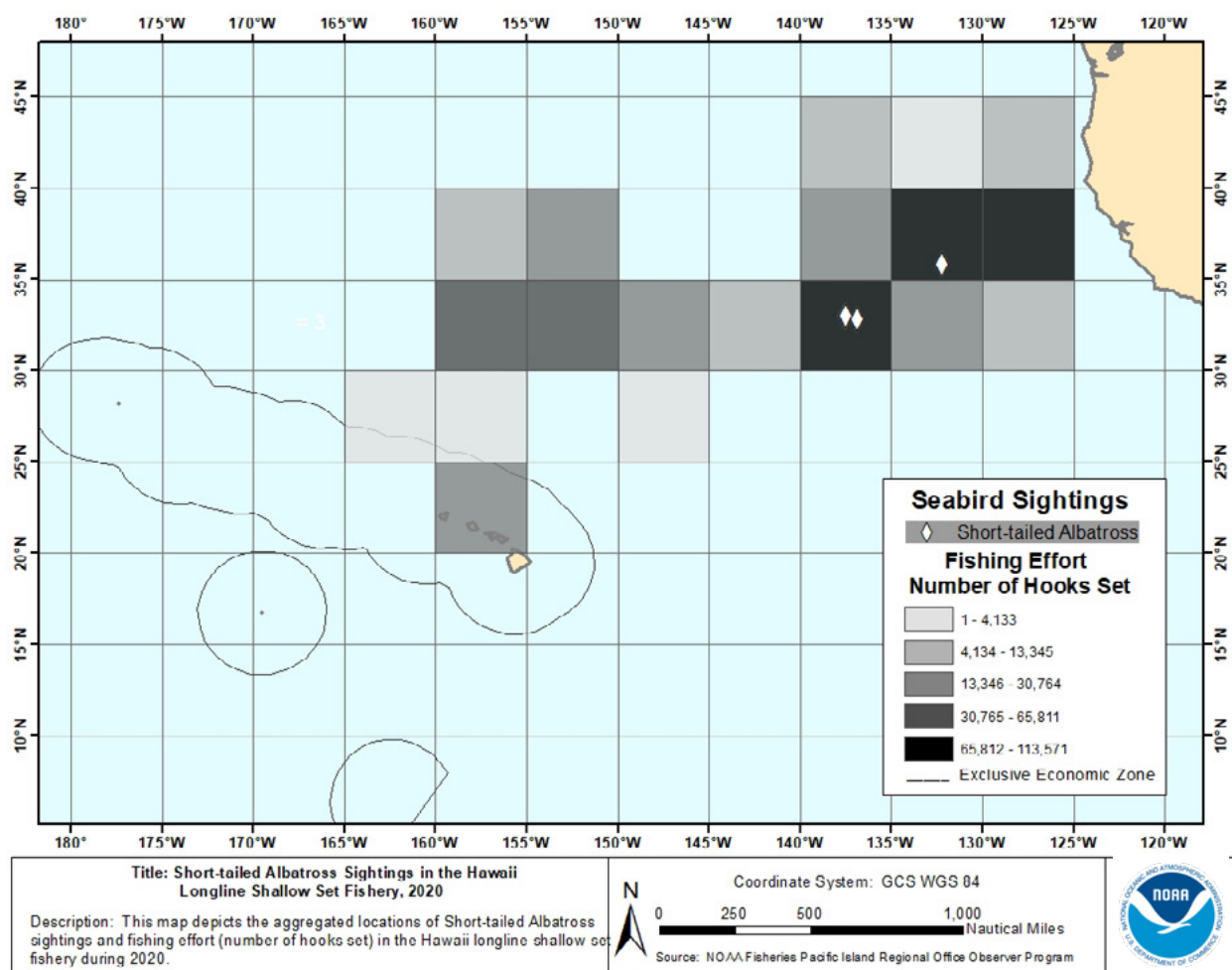
3. ESA-listed Seabirds

There have been no observed interactions (hooking or entanglement) between the fisheries and any ESA-listed seabirds. Three ESA-listed seabird species can be found in areas where the Hawaii longline fisheries operate and are protected under the ESA. These species are the endangered short-tailed albatross (*Phoebastria albatrus*), the Hawaiian dark-rumped

petrel (*Pterodroma sandwichensis*), and the threatened Newell's shearwater (*Puffinus newelli*). There were four sightings of short-tailed albatross on shallow-set trips in 2020 and no sightings on observed deep-set trips. Figure 5 shows the locations of these sightings compared to the observed fishing effort.

Figure 5. Short-tailed albatross sightings and fishing effort in the Hawaii shallow-set fisheries, 2020.

Note: Two short-tailed albatross sightings occurred on the same haul and in the same geographic area. These sightings are represented together as one diamond.
Source: NMFS PIRO Sustainable Fisheries Observer Program, unpublished data, 10/12/2021.



4. Research

Since NMFS introduced seabird regulations to the Hawaii deep-set fishery in 2001, the overall seabird catch rate has declined, with the exception of black-footed albatross catch rates. These rates have been increasing over the past decade and in 2017, the WPFMC held a workshop to explore the cause of increased interactions with black-footed albatross. The workshop suggested this increase may be due to a positive (warm) Pacific Decadal Oscillation—with its cooler sea surface in the Western Pacific and stronger westerly winds—that may increase the overlap of fishing effort and black-footed albatross foraging grounds. In 2018, the WPFMC held a workshop to review seabird mitigation requirements and identify research needed to inform future fishing requirements that would reduce interactions with seabirds. That workshop identified certain mitigation measures, including tori lines, as a high priority for further research and development due to their potential to provide an effective alternative to blue-dyed bait.

In spring 2019, the WPFMC, the Hawaii Longline Association, NMFS Pacific Islands Fisheries Science Center (PIFSC), and PIRO initiated a joint cooperative research project to design and test tori lines in the deep-set longline fishery. The team researched potential tori line materials and designs and discussed tori line preferences and experiences with longline fishermen. In September 2019, the WPFMC convened a meeting with New Zealand and Japanese tori line experts who provided valuable input on tori line design for vessels similar to the Hawaii longline fishery. With that guidance, the project team developed a tori line with a 50 m-long aerial section with a “light” ultra-high molecular weight polyethylene (UHMWPE) backbone with two 50 cm-long streamers attached every 1 m along the aerial section. The tori line also has a non-anchored 55 m-long drag section consisting of braided ¼” co-polymer “blue steel” line to be used during ocean trials.

Between February and July 2020, four commercial longline vessels conducted ocean trials, deploying 175 longline sets during 17 trips. Trial sets included control sets with blue-dyed bait and strategic offal discards, and experimental sets with tori lines in conjunction with blue-dyed bait and strategic offal



Tori lines deployed from a fishing vessel. Credit: NOAA Fisheries.

discards (Gilman et al. 2021). Control and experimental trials utilized electronic monitoring (EM) technology and stern “bird cam” video for data acquisition and posttrip review analysis and verification. The statistically significant results from the 2020 study indicated that tori lines, when used in conjunction with blue-dyed bait and strategic offal discard practices, significantly reduce albatross feeding attempts and contact with longline gear.

On tori line sets, 99.7% of the attempts and contacts by Laysan and black-footed albatrosses occurred within the aerial section of the tori line. Albatross attempts to contact baited hooks were two times less likely for sets equipped with tori lines rather than without tori lines, and contacts with baited hooks were three times less likely for tori line-equipped sets. Albatrosses were also less likely to be captured in tori line sets, but captures during the study were too few to support strong inference compared with the contact

rates. Project results also indicated that discharging offal and spent bait during setting might exacerbate rather than mitigate seabird catch risk. Offal discharge during setting was associated with higher seabird interactions—but that inference was not strong since offal discharge and blue-dyed bait were confounded treatments in some sets (Gilman et al. 2021).

The project results led the WPFMC to identify the need for additional research to test the effectiveness of tori lines without blue-dyed bait and offal discharge (WPFMC 2021). That research began in January 2021 under an experimental fishing permit issued by NMFS pursuant to regulations at 50 CFR 556.17.

5. Summary

Table 10 compares the 2019 and 2020 observed interactions in the two fisheries. The interaction rate from 2019 to 2020 increased for the deep-set fishery and decreased for the shallow-set fishery. In 2019, the shallow-set fishery interacted with 34 seabirds (15 Laysan albatrosses and 19 black-footed albatrosses). In 2020, it interacted with 32 seabirds (26 Laysan albatrosses, 5 black-footed albatrosses, and 1 Northern fulmar). In 2019, observers in the deep-set fishery documented interactions with 189 seabirds (43 Laysan albatrosses, 145 black-footed albatrosses, and 1 brown booby). In 2020, observers in that fishery documented interactions with 156 seabirds (59 Laysan albatrosses, 95 black-footed albatrosses, 1 brown booby, and 1 sooty shearwater) (see Table 6).

Table 10. Comparison of observed interactions in Hawaii longline fisheries, 2019 and 2020.

Observed Interactions	2019	2020
Seabirds observed in deep-set fishery	189	156
Seabirds observed in shallow-set fishery	34	32
Deep-set interaction rate (birds per 1,000 hooks observed)	0.015	0.018
Shallow-set interaction rate (birds per 1,000 hooks observed)	0.091	0.054

Note: There was 20.54% and 15.25% observer coverage in the deep-set longline fishery in 2019 and 2020, respectively, and 100% coverage in the shallow-set longline fishery.

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U.S. Secretary of Commerce
Gina M. Raimondo

Acting Under Secretary of Commerce
for Oceans and Atmosphere
Rick W. Spinrad

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Janet Coit

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